The repetition number of superlattice was 10. The layer compositions were $Al_{0.2}Ga_{0.8}As$ and GaAs. The thickness of each layer was 10 nm. The GaAs layers in the superlattice were doped with Si at a doping density of 2×10^{18} cm^{-3}.

The dislocation density of the epitaxial crystal layers (optical device layer 4) was measured by means of PL mapping using a secondary harmonics YAG laser. More specifically, the monitoring wavelength was 760 nm equal to the peak wavelength of the PL light. The laser spot diameter was approximately 30 μm. The measurement point spacing was 10 μm. The scanned measurement region was 2×2 mm. The peak intensity was mapped, whereby the dislocation density was obtained from the number of dark spots present in the region. The measurement was carried out at two positions each in the center and in the periphery of the epitaxial wafer. The average number of dark spots was 1.9, thereby having given the dislocation density of 47 cm^{-2}. The dislocation density of the GaAs substrate 2 used herein was about 5000 cm^{-2} based on evaluation by an etch pit method.

Example 2

Buffer layer 3 and the epitaxial crystal layers(optical device layer 4) were grown by the same method as in Example 1 except that the Si doping concentration was 1×10^{18} cm^{-3}, and the dislocation density of the epitaxial crystal layer (optical device layer 4) was evaluated according to PL mapping, to find a value of 147 cm^{-2}.

Example 3

Buffer layer 3 and the epitaxial crystal layers(optical device layer 4) were grown by the same method as in Example 1 except that Si doping was not conducted. The dislocation density of the epitaxial crystal layer (optical device layer 4) was evaluated according to PL mapping, to find a value of 340 cm^{-2}.

Example 4

Buffer layer 3 and the epitaxial crystal layers(optical device layer 4) were grown by the same method as in Example 1 except that the repetition number of the buffer layer 3 was 5. The dislocation density of the epitaxial crystal layer (optical device layer 4) was evaluated according to PL mapping, to find a value of 105 cm^{-2}.

Example 5

Buffer layer 3 and the epitaxial crystal layers(optical device layer 4) were grown by the same method as in Example 4 except that the Si doping concentration was 1×10^{18} cm^{-3}, and the dislocation density of the epitaxial crystal layer (optical device layer 4) was evaluated according to PL mapping, to find a value of 325 cm^{-2}.

Example 6

Buffer layer 3 and the epitaxial crystal layers(optical device layer 4) were grown by the same method as in Example 4 except that Si doping was not conducted. The dislocation

density of the epitaxial crystal layer (optical device layer 4) was evaluated according to PL mapping, to find a value of 726 cm^{-2}.

Example 7

An epitaxial laminated film was grown by the same method as in Example 1 except that the number of lamination of the buffer layer 3 was 1. The dislocation density of the epitaxial crystal layer (optical device layer 4) was evaluated according to PL mapping, to find a value of 258 cm^{-2}.

Example 8

Buffer layer 3 and the epitaxial crystal layers(optical device layer 4) were grown by the same method as in Example 7 except that the Si doping concentration was 1×10^{18} cm^{-3}. The dislocation density of the epitaxial crystal layer (optical device layer 4) was evaluated according to PL mapping, to find a value of 802 cm^{-2}.

Example 9

Buffer layer 3 and the epitaxial crystal layers(optical device layer 4) were grown by the same method as in Example 9 except that Si doping was not conducted. The dislocation density of the epitaxial crystal layer (optical device layer 4) was evaluated according to PL mapping, to find a value of 1880 cm^{-2}.

Example 10

Buffer layer 3 and the epitaxial crystal layers(optical